

Body Temperature and Comfort.

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These records have been taken from the same subject with the same clinical thermometers during residence in various climates—Scotland, Malaya, Java and Australia. They cover a period of six years.

It is well known that, so delicate is the heat regulating system of man, his temperature is only slightly influenced by the temperature of his surroundings. This fact is shown by records of temperature in the Tropics and in the Arctic regions. By wearing appropriate clothing and living in suitable quarters the temperature remains practically the same.

In this paper the temperature of the well-closed and dry axilla is taken as a guide to the temperature of the body. The temperature of the mouth as well as the wet and dry bulb readings for the atmosphere are also given. Observations were made in the same room always, in each case. The thermometers were left in situ for four minutes. With the clinical thermometers employed, this was found to be sufficient, although Pembrey (1) says, "in order to obtain accurate results the thermometer should be retained for eight minutes in the mouth and eleven minutes in the well-closed and dry axilla."

Meals were taken as follows, morning tea between 6 a.m. and 7 a.m., breakfast between 8 a.m. and 9 a.m., lunch between 1 p.m. and 2 p.m., afternoon tea between 4 p.m. and 5 p.m., dinner between 7.30 p.m. and 8.30 p.m., except in the case of the Blue Mountains where the evening meal was taken between 6.30 p.m. and 7.30 p.m. There is a rise in temperature after a meal (2).

Exercise—walking, golf or tennis—was taken fairly regularly. The letter E on the charts denotes exercise. Exercise produces a rise in temperature, which disappears soon after cessation of the exercise (3).

Standard works state that, speaking generally, the temperature rises during the morning and the afternoon, but falls during the evening and early part of the morning (4).

In the present work all the records are comparable as regards daily routine. They were taken during holidays.

The subject is a thin healthy man aged 34 years, 5 ft. 9 ins. in height and 10 stone 4 lbs. in weight.

The readings are given in Fahrenheit scale.

RECORDS IN VARIOUS CLIMATES.

Edinburgh, Scotland.—During residence in Edinburgh, the temperature in the axilla averaged 97° (Chart I). This was the case for at least eight years. This axillary temperature is much below the mean daily temperature of the average man, which is usually given as 98.45° (5). The low temperature is explained by the fact that the subject has a normal temperature below the average. The records given on Chart I. were taken during residence at a hospital in Edinburgh. The mean annual atmospheric temperature for Edinburgh is 47.7° .

Bungalow No. I. Singapore.—This bungalow is situate on a hill, about 150 feet above the sea. It looks out over the harbour and nearly always enjoys a cool breeze. Whilst in this bungalow the subject very rarely felt uncomfortably hot. On these occasions there was no breeze. On Chart II it will be seen that the average axillary temperature was 97.1° , practically the same figure as for Edinburgh. The mouth temperature averaged 97.7° . It occasionally fell below that of the axilla. This was probably due to mouth-breathing, the subject suffering fairly frequently from nasal catarrh. The mouth is always liable to considerable local variation of temperature, but the axilla is not.

It was observed that an axillary temperature of 97.6° produced discomfort.

The average wet and dry bulb readings were 76.3° and 81.4° respectively, the atmosphere being warm and moist.

Ordinary white ducks with light woollen vests were worn. Ninety nine people out of a hundred in Singapore wear white ducks or very similar clothing. This is sufficient proof of their comfort to the ordinary individual. Some object to them because of the glare. Wearing dark coloured spectacles will overcome this trouble.

Lembang, Java.—On Chart III are given records of nine days' residence at Lembang, 4000 feet above the sea. The average axillary and mouth temperatures were 96.7° and 97.2° respectively, the subject, feeling comfortably cool. The atmospheric temperature was fairly low, the readings being 64.7° for the wet bulb and 69.1° for the dry bulb. Warm clothing was worn during the evenings.

Between the hours 2 p.m. and 4 p.m., the hottest time of the day it was occasionally uncomfortable, the axillary temperature being 97.6° or more.

Bungalow No. II. Singapore.—During succeeding years the subject experienced several uncomfortably hot bungalows. Chart IV. gives the records taken in such a bungalow. The average axillary temperature was 97.6° . This caused discomfort. It will be seen that as far as atmospheric temperature and moisture were

concerned the conditions were similar to those given for Bungalow No. I. The wet and dry bulb readings were 76.3° and 81.4° respectively for No. I., and 76.7° and 81.5° respectively for No. II. Why then did No. II feel much hotter? Because it is situate almost on sea level, and it is closely surrounded on three sides by hills and dwellings. The fourth side is not open, but the hills and dwellings here are further off and very rarely a breeze finds its way in by this side. There were no electric fans; had these been available the conditions would have been much improved. Heat is lost by radiation, conduction, convection and evaporation. The skin and respiratory tract are especially concerned. Radiation, conduction and convection from the body are lessened in a warm atmosphere; and a moist atmosphere retards evaporation; but a breeze aids conduction and convection and cools the skin. Therefore, in our warm and moist climate, maximum use should be made of any breeze that is available and hill sites should be chosen for bungalows. All buildings should be supplied with electric fans.

Taiping Hill, Perak. Chart V shows the records obtained during a holiday on this comfortable hill-station 3,400 feet above sea level. Only once or twice, for short periods, did the subject feel uncomfortably hot and on these occasions the axillary temperature was 97.6° or more. The average wet and dry bulb readings were 68.7° and 71.3° respectively. The average axillary temperature was 96.9° and the average mouth temperature 98.1° . Fires and warm clothing were employed after 5 p.m.

Katoomba, Blue Mountains, Australia.—Several months were spent near Katoomba, 2,300 feet above the sea. Some few days were fairly hot, but on the whole the weather was wet and cool, the wet bulb average being 66.2° and the dry bulb 67.6° . The average axillary temperature was 97.2° and the average mouth temperature was 97.8° . Warm clothing and fires were used frequently.

SUMMARY.

It will be seen from Chart VII that so long as the axillary temperature of the subject, under observation, was about 97° , he felt comfortable. A rise to 97.6° produced an uncomfortably hot feeling. For each person there will be similar temperatures, varying slightly in each case.

It is of interest to note that in the breezy bungalow No. I. Singapore, the axillary temperature was about the same as that given for various cooler climates. A bungalow properly built, equipped and placed in Singapore, offers very comfortable conditions. In our warm and moist climate maximum use should be made of any available breeze and hill sites should be chosen for residences. There is no doubt that, in unfavourably placed residences, the temperature of the body is higher than it should be. It may be only slightly higher, but this is sufficient to produce considerable discomfort and in time, considerable damage to health.

O'Connell (6), in discussing the etiology of malaria, points out that hot, moist and still air has a good deal to do with outbreaks of this disease. It is well known that, in badly ventilated factories at home, this atmospheric condition causes a definite rise of temperature, great discomfort and a weakening of the system. O'Connell also quotes, H. M. Chief Inspector of Factories—"The general opinion I have formed from the detailed study of the observations (in the cotton sheds) is that a rise of mouth temperature makes itself felt when the wet bulb (temperature of the air) exceeds 75° F." In my records it will be observed that 75° was exceeded in both bungalows No. I. and No. II; but in bungalow No. I the cool breeze, by aiding conduction and convection of heat, counteracted the ill effects of the excessive heat and moisture, thus producing bodily comfort. In bungalow No. II. the absence of a breeze caused great discomfort; electric fans would have improved conditions.

The chances of a breeze in the thickly populated areas of this town are small and undoubtedly our unfavourable atmospheric conditions—heat and moisture—are free to exert their greatest ill in these quarters. Our high death rate shows that they do so.

REFERENCES.

1. Pembrey M. S. Text Book of Physiology, Vol. I, edited by E. A. Schäfer, page 786.
2. Ibid, page 809.
3. Ibid, page 806.
4. Ibid, page 798.
5. Ibid, page 788.
6. O'Connell, M.D. Journ. Trop. Med. and Hyg., Sept. 1st, 1913.